13394 - Spectroscopic confirmation of the first symbiotic star in a globular cluster

Cycle: 21, Proposal Category: GO

(Availability Mode: SUPPORTED)

INVESTIGATORS

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VISITS

Visit	*Targets used in Visit*	*Configurations used in Visit*	*Orbits Used*	*Last Orbit Planner Run*	*OP Current with Visit?*
01	(1) NGC1851-OFFSET1 (2) NGC1851-OFFSET2 (3) NGC1851-FUV1	STIS/CCD	2	15-May-2014 16:00:36.0	yes

2 Total Orbits Used

ABSTRACT

We have recently discovered an 18-minute period in the ultraviolet of a star in the globular cluster NGC 1851. In the redder optical bands, this star is red and bright, while it shows a clear UV excess relative to other stars at similar positions in the HR diagram. The system is most likely a symbiotic binary, composed of a cool evolved star and a white dwarf, with an 18 minute spin period, accreting the cool star's wind. The binary would be the first such object ever found in a globular cluster, and only the third in the Galaxy where the white dwarf spin period is measured. The only viable

alternatives are that the two components are a chance superposition -- something with a nontrivial chance of happening in a globular cluster core. In such a case, the 18 minute period would most likely be the spin period of a magnetic white dwarf in an intermediate polar cataclysmic variable (this would be the first confirmed magnetic CV in a globular cluster), or the orbital period of a double-degenerate AM CVn binary. Each of these three possibilities show unique (and very different) emission line spectra in the blue wavelength range. Two orbits of HST with STIS/G430L will produce a spectrum of sufficient signal-to-noise to distinguish between these 3 scenarios. The result will be an important constraint on N-body models of globular clusters.

OBSERVING DESCRIPTION

The cluster center where our target star is located is extremely crowded and would make acquiring and peaking up extremely difficult. In order to alleviate this difficulty we will acquire and peak up on a red giant located to the south and east of our target star out side the most crowded region. We will then move to a second red giant which is closer to our target (about half the distance) and peak up on this second red giant before moving to our target star. Our target star is located right in the cluster core. Once we have moved to our target star we will expose using the grating G430L for the rest of the time. The positions for the two red giants and our target star have been determined using the reference image J9L910010 from proposal 10775 (PI: Sarajedini).

Visit

Proposal 13394, NGC1851-FUV1 (01), implementation Thu May 15 20:00:38 GMT 2014

Diagnostic Status: No Diagnostics

Scientific Instruments: STIS/CCD

Special Requirements: PCS MODE FINE

Fixed Targets

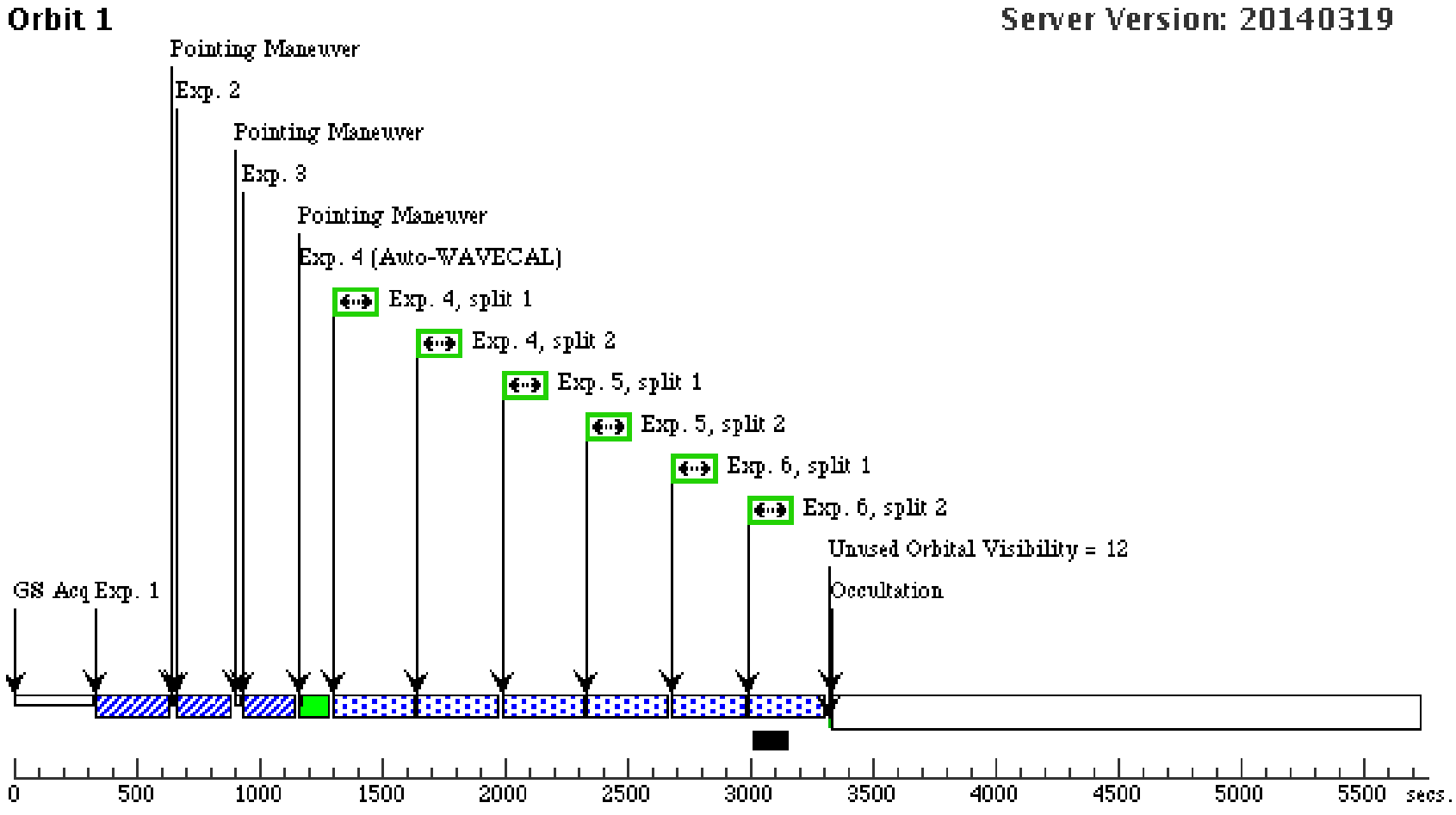
#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous
(1)	NGC1851-OFFSET1	RA: 05 14 7.0100 (78.5292083d) Dec: -40 02 58.70 (-40.04964d) Equinox: J2000		V=13.0+/-0.1	Reference Frame: ICRS
Comments: This is a red giant located to the south and east of our target. This is using the data from proposal 10775 ACS/WFC imaging (J9L910010).					
(2)	NGC1851-OFFSET2	RA: 05 14 6.3610 (78.5265042d) Dec: -40 02 53.67 (-40.04824d) Equinox: J2000		V=13.0+/-0.1	Reference Frame: ICRS
Comments: This is a second red giant star located closer to the target star. It is slightly to the south and west of our target. The position is determined from the proposal 10775 ACS/WFC imaging (J9L910010).					
(3)	NGC1851-FUV1	RA: 05 14 6.5730 (78.5273875d) Dec: -40 02 49.85 (-40.04718d) Equinox: J2000		V=16.0+/-0.1	Reference Frame: ICRS
Comments: This is our target star. It is located slightly north and west of the red giant. It is located right in the center of the cluster and is thus extremely hard to peak up on. The position is determined from the proposal 10775 ACS/WFC imaging (J9L910010).					

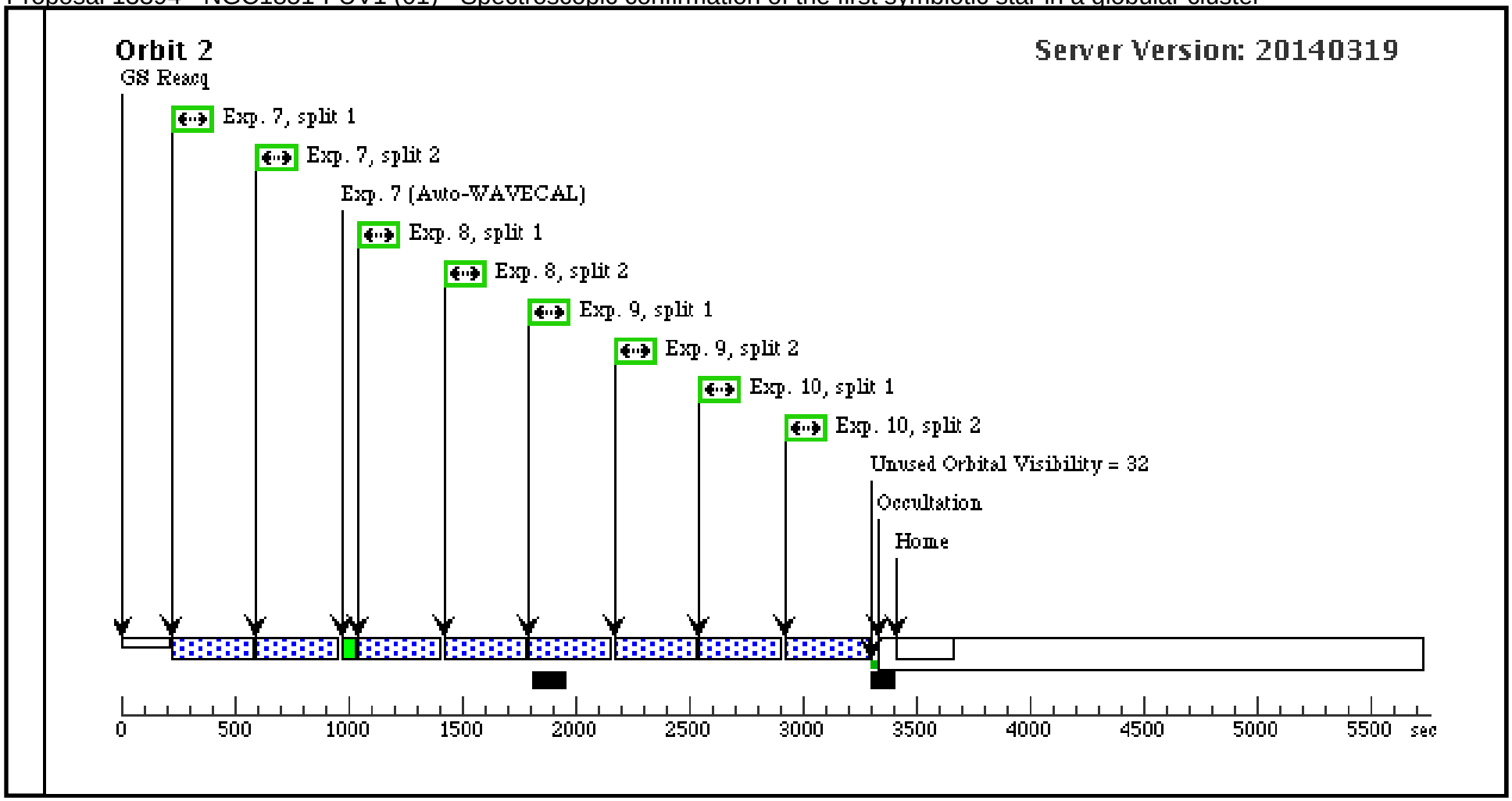
Exposures

#	Label (ETC Run)	Target	Config,Mode,Aperture	Spectral Els.	Opt. Params.	Special Reqs.	Groups	Exp. Time (Total)/[Actual Dur.]	Orbit
1	NGC1851-OFFSET1 (STIS.ta.518415)	(1) NGC1851-OFFSET1	STIS/CCD, ACQ, F25ND3	MIRROR				2.6 Secs (2.6 Secs) *[==>]*	***[1]***
	Comments: This is the first red giant located south and slightly to the east of our target. We will acquire and peak up on this star. It's magnitude is about 13.0 and is one of the brightest red giants in this part of the cluster. The cluster core, where our target is, is too crowded and acquisition is not possible.								
2	NGC1851-OFFSET1 (STIS.ta.518418)	(1) NGC1851-OFFSET1	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				1 Secs (1 Secs) *[==>]*	***[1]***
	Comments: This is the first red giant located south and slightly to the east of our target. We will acquire and peak up on this star. It's magnitude is about 13.0 and is one of the brightest red giants in this part of the cluster. The cluster core, where our target is, is too crowded and acquisition is not possible.								
3	NGC1851-OFFSET2 (STIS.ta.518418)	(2) NGC1851-OFFSET2	STIS/CCD, ACQ/PEAK, 52X0.1	MIRROR				1 Secs (1 Secs) *[==>]*	***[1]***
	Comments: This is a second red giant which is closer to our target. It is located to the south and slightly to the west of our target. We will preform a peak up on this red giant and then proceed to our target star.								
4	NGC1851-FUV1 (STIS.sp.518425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A				600 Secs (600 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit.								
5	NGC1851-FUV1 (STIS.sp.518425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A				600 Secs (600 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit.								
6	NGC1851-FUV1 (STIS.sp.518425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A				550 Secs (550 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[1]***
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit. *Note: this exposure has been adjusted to fill the orbit.*								
7	NGC1851-FUV1 (STIS.sp.518425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A				660 Secs (660 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit. *We adjusted the exposure time to 660 seconds to fill the orbit better.*								
8	NGC1851-FUV1 (STIS.sp.518425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A				660 Secs (660 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	***[2]***
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit. *We adjusted the exposure time to 660 seconds to fill the orbit better.*								

	9	NGC1851-F UV1 (STIS.sp.51 8425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A	660 Secs (660 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	**[2]**
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit. *We adjusted the exposure time to 660 seconds to fill the orbit better.*						
	10	NGC1851-F UV1 (STIS.sp.51 8425)	(3) NGC1851-FUV1	STIS/CCD, ACCUM, 52X0.1	G430L 4300 A	660 Secs (660 Secs) *[==>(Split 1)]* *[==>(Split 2)]*	**[2]**
	Comments: We wish to obtain a series of spectra with a signal-to-noise of about 30 in the continuum within each spectrum. This works out to about a 600 seconds. We will continue to take spectra of this length for the rest of the visit. *We adjusted the exposure time to 660 seconds to fill the orbit better.*						

Orbit Structure




Orbit 2
Server Version: 20140319
GS Reacq
Exp. 7, split 1
Exp. 7, split 2
Exp. 7 (Auto-WAVECAL)
Exp. 8, split 1
Exp. 8, split 2
Exp. 9, split 1
Exp. 9, split 2
Exp. 10, split 1
Exp. 10, split 2
Unused Orbital Visibility = 32
Occultation
Home
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
sec